

# UEC Aquifer Exemption Boundary

**EPA Region 6  
Dallas  
1/18/12**





# Aquifer Exemption Boundary

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- **Objective:**

- Demonstrate that no existing domestic well that is currently used for human consumption is using water from the AE Area
- Demonstrate that no existing domestic well could produce water from the AE Area for the entire mine life

- **Approach:** Use accepted EPA capture zone methods and site data to delineate capture zones



# Capture Zone Time Frame

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- We will perform calculations of capture for the 8 year mine life provided in the issued permit.
- This is consistent with:
  - 40 CFR 146.6
  - Region 6 EPA's response to UEC's Application received on May 27, 2011



# Capture Zone Approach

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1. Tabulate the rural domestic wells to be considered in the AOR and detail what strata each is completed in, where known.
2. Calculate average hydraulic gradients in each stratum
3. Calculate the 8 year capture zones for each rural domestic well and plot relative to the AE Boundary

# 8 year Capture Zone

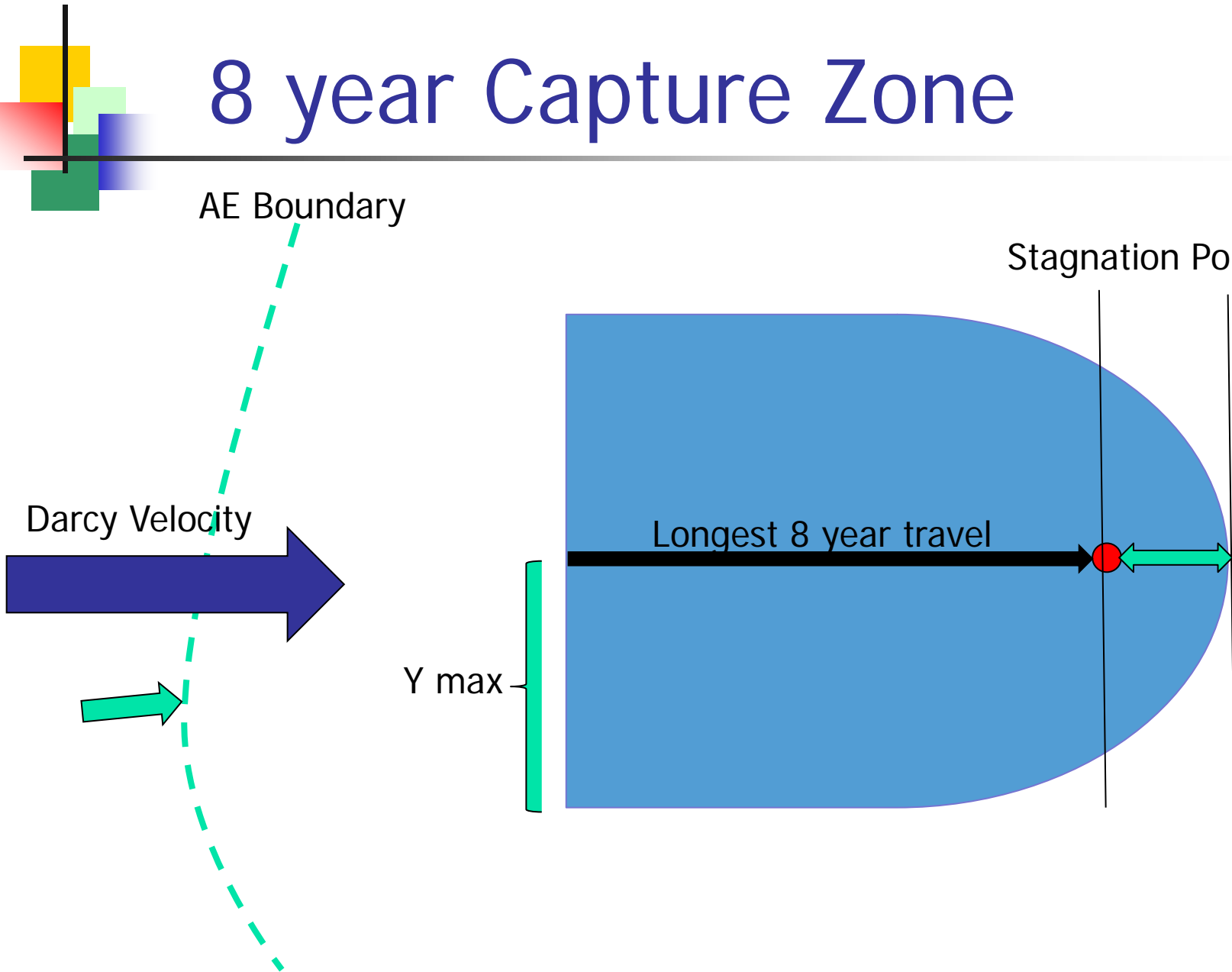
AE Boundary

Stagnation Point  $X_o$

Darcy Velocity

Longest 8 year travel

Y max







# Variables / Nomenclature

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$Q$	=	Extraction rate at rural/domestic well ( $L^3/T$ )
$K$	=	Average hydraulic conductivity of stratum ( $L/T$ )
$b$	=	Average thickness of stratum ( $L$ )
$T$	=	Average transmissivity ( $K * b$ ) of stratum ( $L^2/T$ )
$i$	=	Average hydraulic gradient ( $L/L$ )
$\Phi$	=	Porosity of stratum ( $L^3/L^3$ )
$v$	=	Average seepage velocity ( $L/T$ )
$x$	=	Coordinate parallel to seepage velocity direction
$y$	=	Coordinate normal to seepage velocity direction



# Capture Model Properties

Stratum	Average Thickness (ft)	Average Hydraulic Gradient	
		Magnitude (ft/ft)	Direction (degrees)
A	65	TBD	TBD
B	36	TBD	TBD
C	36	TBD	TBD
D	80	TBD	TBD

- We have good sand hydraulic properties from two large-scale pump tests and a calibrated flow model of the B-sand



# Rural/Domestic Use

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- 2009 Water use survey data (Kevin Kluge, TWDB)
- Based upon municipal use and population – TWDB does not calculate a county gpd/capita for rural/domestic
- Goliad County = 119 gpd/person
  - State average = 150 gpd/person
- Average household in Goliad County is comprised of 2.6 people
  - <http://www.goliadcc.org/index.php/re-location-info.html>



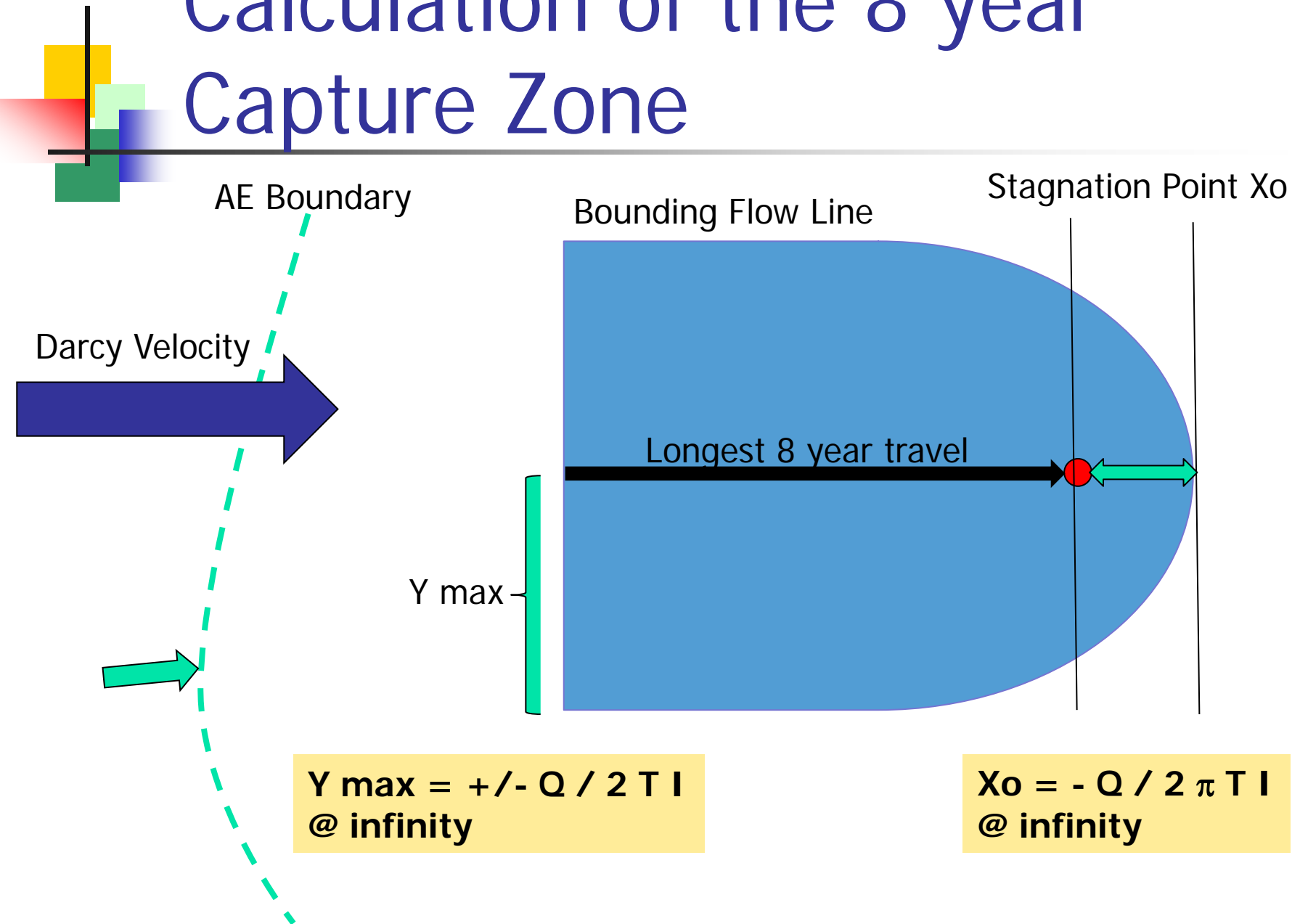


# Rural/Domestic Use

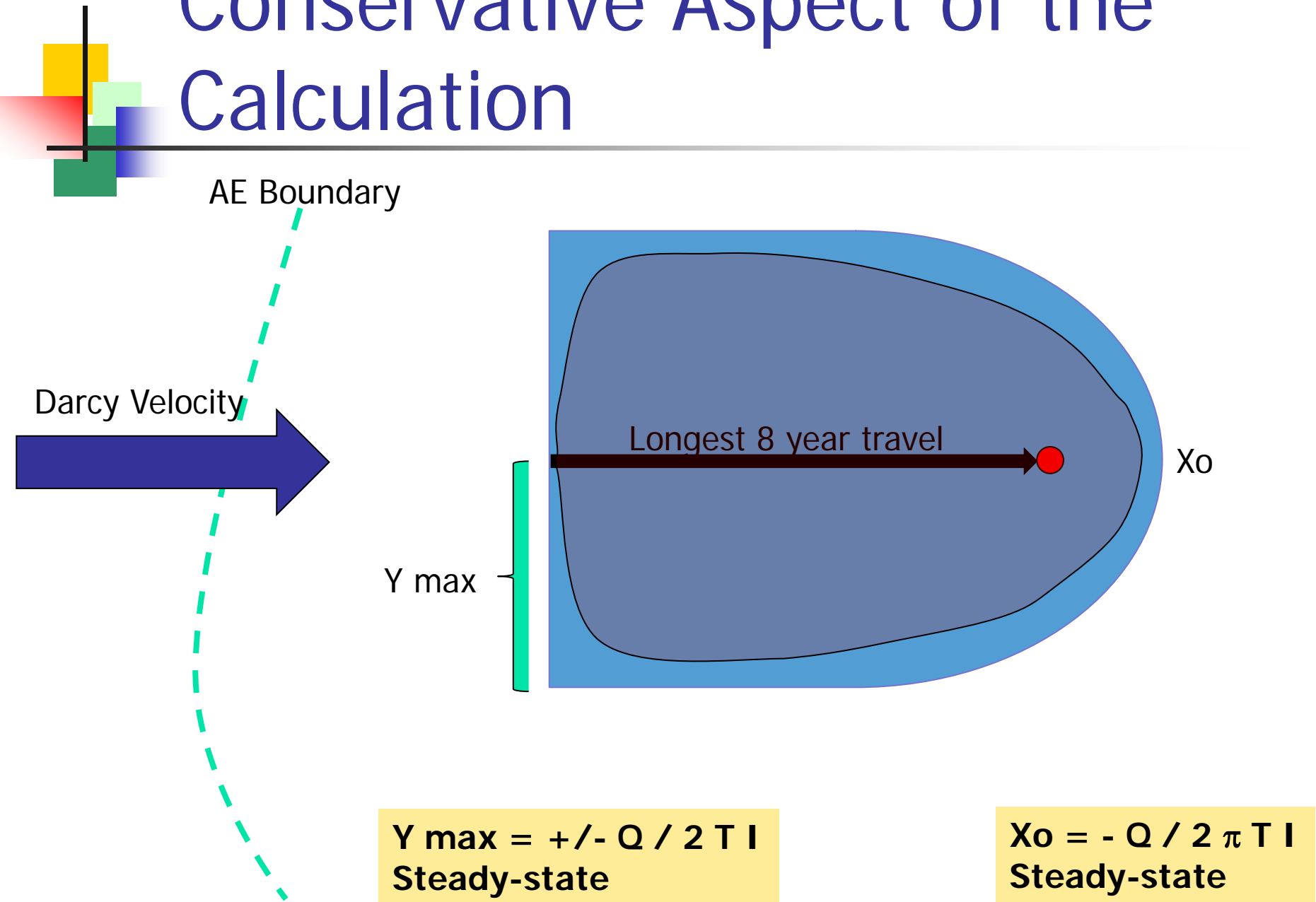
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- $2.6 \text{ people} \times 119 \text{ gpd/person} = 309.4 \text{ gpd}$
- $309.4 \text{ gpd} = 0.215 \text{ gpm} = 41.4 \text{ ft}^3/\text{day}$

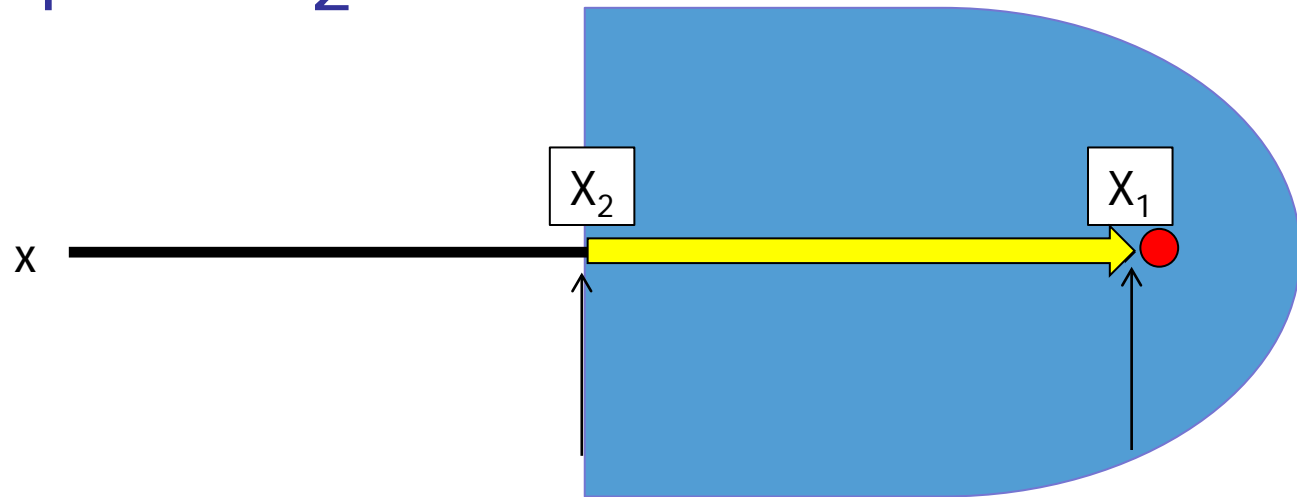
# Calculation of the 8 year Capture Zone



# Conservative Aspect of the Calculation



# Travel Time Calculation from $X_1$ to $X_2$



Travel Time from  $x_2$  to  $x_1$  =

$$\{vx_2 - Q/2\pi b\phi [\ln (vx_2 + Q/2\pi b\phi)]\} / v^2 -$$

$$\{vx_1 - Q/2\pi b\phi [\ln (vx_1 + Q/2\pi b\phi)]\} / v^2$$



# Product to EPA

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- Review all wells in the AOR and provide verification of where the wells are completed where we have data
- Develop reasonable estimates of:
  - Aquifer properties
  - Hydraulic gradients
  - Rural/domestic pumping rate



# Product to EPA

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- Provide plots of the 8 year capture zones for each rural/domestic well in the AOR
  - If a well is known to be completed in a particular stratum, calculations for that well will be limited to that stratum
  - If completion of a well is unknown, the calculations will be performed assuming all four potential strata
- Technical memorandum documenting results



